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(22)Date of filing : 30.05.1994 (72)Inventor : IINO RYOICHI

(54) HEAT-SENSITIVE RECORDING MEDIUM

(57)Abstract:

PURPOSE: To provide a heat-sensitive recording medium of good alteration and forgery preventing properties which can record the high picture quality at high speed, change and modify the information.

CONSTITUTION: A heat-sensitive recording medium A is composed of a base 1, an aluminum layer 2 formed on the base 1, a first heat-sensitive recording layer 3 formed on the aluminum layer 2, a light and heat conversion layer 4 formed on the first heat-sensitive recording layer 3, a second heat-sensitive recording layer 5 formed on the light and heat conversion layer 4, in which the optical density is varied depending on the temperature at the time of recording, and recording and erasing can be carried out reversibly and a protective layer 6 formed on the second heat-sensitive recording layer 5 as main sections. The high speed

recording or erasing of the information can be carried out by a heating means using a thermal head only for the second heat-sensitive recording layer, and recording or erasing of information can be carried out simultaneously for the first heat-sensitive recording layer and the second heat- sensitive recording layer by a heating means using laser beam.

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CLAIMS

[Claim(s)]

[Claim 1] The thermal-recording medium characterized by to carry out sequential

formation of the light-and-heat conversion layer which uses as a principal component the light-absorption agent distributed in the first heat-sensitive recording layer, and resin and this resin, absorbs light, and generates heat on a base material, and the second heat-sensitive recording layer where the organic low-molecular matter distributed in resin and this resin is used as a principal component, and the transparency changes reversibly depending on temperature.

[Claim 2] The thermal recording medium according to claim 1 by which the first heat-sensitive recording layer of the above is characterized by consisting of irreversible thermal recording ingredients.

[Claim 3] The thermal recording medium according to claim 1 characterized by consisting of reversible thermal recording ingredients from which the first heat-sensitive recording layer of the above uses as a principal component the organic low-molecular matter distributed in resin and this resin, and the transparency changes reversibly depending on temperature.

[Claim 4] The thermal recording medium according to claim 1, 2, or 3 characterized by the thermal break intervening between the above-mentioned light-and-heat conversion layer and the second heat-sensitive recording layer.

[Claim 5] The light-and-heat conversion layer which uses as a principal component the light absorption agent distributed in resin and this resin, absorbs light, and generates heat on a base material, Sequential formation of the first irreversible heat-sensitive recording layer and the second heat-sensitive recording layer where the organic low-molecular matter distributed in resin and this resin is used as a principal component, and the transparency changes reversibly depending on temperature is carried out. And the thermal recording medium by which thermal recording temperature of the first heat-sensitive recording layer of the above is characterized by being an elevated temperature from the thermal recording temperature of the second heat-sensitive recording layer.

[Claim 6] The thermal recording medium by which sequential formation of the first irreversible heat-sensitive recording layer where the light absorption agent was

added, and the second heat-sensitive recording layer where the organic low-molecular matter distributed in resin and this resin is used as a principal component, and the transparency changes reversibly depending on temperature is carried out on the base material, and thermal recording temperature of the first heat-sensitive recording layer of the above is characterized by being an elevated temperature from the thermal recording temperature of the second heat-sensitive recording layer.

[Claim 7] The thermal recording medium according to claim 5 or 6 characterized by the thermal break intervening between the first heat-sensitive recording layer of the above, and the second heat-sensitive recording layer.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to a thermal recording medium recordable [with a thermal head and a laser beam], and especially, while a high speed and high-definition record are possible and informational modification and correction are easy, alteration / forged prevention property is related with a good thermal recording medium.

[0002]

[Description of the Prior Art] From the former, thermal recording is widely used as output means, such as a word processor and a personal computer, and an information record means to various PURIPEDO cards, such as a Highway Card and an IO card (JR sale). Once only record is possible and it records it as a record medium used for these thermal recording, the irreversible thing which is not eliminable occupies the mainstream.

[0003] By the way, in gold notes, such as the above-mentioned PURIPEDO card,

thermal recording is performing the sum total of the use amount of money, and the display of the balance. And by the thermal recording medium which cannot eliminate the information currently recorded from it being the figure which changes according to an operating condition, and cannot be recorded again, since the count of use followed on increasing and the write-in tooth space of a use detail was lost, these had the fault from which record of new information becomes difficult.

[0004] Then, much proposals are made in recent years about the reversible thermal recording medium which carried out the laminating of a reversible thermal recording ingredient and this on the base material.

[0005] In many cases, record of the information on the above-mentioned reversible thermal recording medium is performed by the thermal head. Drawing 12 shows the sectional view of the reversibility thermal recording medium for thermal heads concerning the conventional example, and this thermal recording medium A has the composition that the laminating of the vacuum-plating-of-aluminium layer 101, the reversibility heat-sensitive recording layer 102, and the protective layer 103 was carried out one by one on the base materials 100, such as paper and resin. And the heat generated from the thermal head S will pass a protective layer 103, will arrive at the reversibility heat-sensitive recording layer 102, and will be in a transparent elimination condition or the record condition which became cloudy according to that attainment temperature, and this change is reversible. For example, if the reversibility heat-sensitive recording layer 102 is in a record condition, silver of the vacuum-plating-of-aluminium layer 101 used as a substrate can be made into a background, and white recording information can be observed. In addition, about the thickness of the reversibility heat-sensitive recording layer 102, in order to raise whenever [nebula / at the time of record], it usually needed to be made 6.0 micrometers or more.

[0006] By the way, in record / elimination method by such thermal head, since heat was transmitted from the top-face side of the above-mentioned protective layer 103, when this protective layer 103 was thickened, the case where record

and elimination of the reversibility heat-sensitive recording layer 102 became difficult had it. For this reason, the thickness of the above-mentioned protective layer 103 had to be thinly set up with about 2.0 micrometers. However, if the thickness of a protective layer 103 is thin, since the reversibility heat-sensitive recording layer 102 will react also to the heat from the outside other than a thermal head, it writes in, when heat is added from the exterior, and data will disappear or it will also be able to make it easy to heat intentionally, and to alter and forge recording information. Therefore, since it was inferior to the thermal stability of recording information and an alteration and forgery of recording information were easy to be carried out, the reversibility thermal recording medium for thermal heads had the trouble that the applicability will be limited, with a gold note like a PURIPEDO card.

[0007] The thermal recording approach of replacing with the above-mentioned thermal head as a heat source, and on the other hand using a laser beam is also proposed (refer to JP,48-85153,A and JP,49-131142,A). Drawing 13 shows the sectional view of the reversibility thermal recording medium for laser beam thermal recording concerning the conventional example indicated by these official reports. That is, this thermal recording medium A has the composition that the laminating of the vacuum-plating-of-aluminium layer 101, the light-and-heat conversion layer 104, the reversibility heat-sensitive recording layer 102, and the protective layer 103 was carried out one by one on the base material 100. Moreover, it is emitted from semiconductor laser L, and is condensed by the condensing optical system F, and a laser beam penetrates a protective layer 103 and the reversibility heat-sensitive recording layer 102, is absorbed in the light-and-heat conversion layer 104, and is changed into heat. And the above-mentioned reversibility heat-sensitive recording layer 102 becomes either of the record conditions which became cloudy with the transparent elimination condition with the attainment temperature like the case where the heat generated in the above-mentioned light-and-heat conversion layer 104 uses propagation and a thermal head for the reversibility heat-sensitive recording layer 102. Thus, in the

thermal recording medium using a laser beam, since the heat source will exist in the interior of a thermal recording medium, it becomes possible to take values arbitrary about the thickness of the above-mentioned protective layer 103. Therefore, since the thickness of a protective layer 103 can be greatly set up compared with the case where a thermal head is used, while it is hard coming to win popularity the effect of the heat from the outside and the thermal stability of recording information improves, an improvement of alteration / forged prevention property can also be aimed at.

[0008] However, since it was difficult to array-ize many like the heating element of the above-mentioned thermal head in a laser light source, the heating value per [which is given to a reversible thermal recording medium] unit time amount decreased, and there was a trouble of bringing about the remarkable fall of the part, and record and erasing speed.

[0009] Moreover, the reinforcement of a laser beam had Gaussian distribution, and since energy density was very high compared with the thermal head, it had the trouble that the temperature of the light-and-heat conversion layer 104 neighborhood will exceed 200 degrees C if nebula record of the reversibility heat-sensitive recording layer 103 which has the thickness of 6.0 micrometers or more fully tends to be carried out, the reversibility heat-sensitive recording layer 102 was exposed to an elevated temperature, and the part was easy to damage. Since the laser output had to be reduced even if it sacrificed the fall whenever [nebula / some] for making it not, damage the reversibility heat-sensitive recording layer 102 on the other hand, there was also a trouble that the image quality and contrast of recording information fell.

[0010] Furthermore, the information recorded on the output of a computer, a word processor, etc. or a PURIPEDO card also had the fundamental problem that it was made to the applicability as for constraint that importance cannot be attached to security nature and what must not be eliminable can perform only eliminable reversible thermal recording for a certain reason.

[0011]

[Problem(s) to be Solved by the Invention] the case where what kind of configuration is taken by the thermal recording medium applied to the conventional example as mentioned above -- Uchi of informational modification / correction property, alteration / forged prevention property, the rapidity of record, and the image quality and contrast of recording information -- it had at least one or more troubles.

[0012] The place which this invention was made paying attention to such a trouble, and is made into the technical problem has alteration / forged prevention property in offering a good thermal recording medium while a high speed and high-definition record are possible and informational modification and correction are easy.

[0013]

[Means for Solving the Problem] Invention concerning claim 1 on a base material Namely, the first heat-sensitive recording layer, The light-and-heat conversion layer which uses as a principal component the light absorption agent distributed in resin and this resin, absorbs light, and generates heat, It is characterized by carrying out sequential formation of the second heat-sensitive recording layer where the organic low-molecular matter distributed in resin and this resin is used as a principal component, and the transparency changes reversibly depending on temperature.

[0014] And since it has the first heat-sensitive recording layer and second heat-sensitive recording layer through the above-mentioned light-and-heat conversion layer in the thermal recording medium concerning this invention according to claim 1, it becomes possible to perform informational high-speed record or informational elimination with the heating means using a thermal head to the second heat-sensitive recording layer located in a front-face side. In this case, since the above-mentioned light-and-heat conversion layer cannot get across to the first heat-sensitive recording layer where it functions as a thermal break according to an operation of that resinous principle, and the heat from a thermal head is located in a base material side easily, when informational record or

informational elimination is made to the second heat-sensitive recording layer by the heating means using a thermal head, record or elimination of the information on the first heat-sensitive recording layer is not made.

[0015] On the other hand, when informational write-in actuation is performed by the heating means using a laser beam, since the heat generated from the above-mentioned light-and-heat conversion layer gets across to the first heat-sensitive recording layer and second heat-sensitive recording layer almost equally, unless the thermal recording temperature of both heat-sensitive recording layers is sharply different, it becomes possible [performing informational record or informational elimination to two-layer coincidence]. And about the information recorded on the first heat-sensitive recording layer, it becomes possible to aim at an improvement of alteration / forged prevention property (security nature) in a thermal recording medium according to an operation of the above-mentioned light-and-heat conversion layer, since informational rewriting or informational elimination by the thermal head is difficult.

[0016] In addition, about the first heat-sensitive recording layer of the above, this may be constituted from an irreversible thermal recording ingredient, you may constitute from a reversible thermal recording ingredient, and it is arbitrary. However, when constituted from an irreversible thermal recording ingredient, since the information which is not eliminable to the first heat-sensitive recording layer can be written in, an improvement can be aimed at from that of security nature. Invention concerning claim 2 is made for such a reason for technical.

[0017] That is, invention concerning claim 2 is characterized by the first heat-sensitive recording layer consisting of irreversible thermal recording ingredients a premise [the thermal recording medium concerning invention according to claim 1].

[0018] In addition, as an irreversible thermal recording ingredient, the thing which made acid, such as colorless leuco colors, such as crystal violet lactone, and bisphenol A, contain in a recording layer is mentioned, for example. That is, in this ingredient, if a recording layer is heated with heating means, such as a

thermal head, both a colorless leuco color, or both [one side or] will fuse, and it will react chemically, and the lactone ring of a leuco color goes out, and a heating part colors in purple-blue.

[0019] On the other hand, since the same recording information can be recorded with the heating means using a laser beam to both heat-sensitive recording layers when constituted from a reversible thermal recording ingredient like [heat-sensitive recording layer / first] the second heat-sensitive recording layer, even if it sets each record layer thickness as the conventional one half, it also becomes possible to reduce the output of a laser beam irradiated from not producing a problem in whenever [nebula] and thickness becoming half. Invention concerning claim 3 is made from such a reason for technical.

[0020] That is, invention concerning claim 3 is characterized by consisting of reversible thermal recording ingredients from which the first heat-sensitive recording layer uses as a principal component the organic low-molecular matter distributed in resin and this resin a premise [a thermal recording medium according to claim 1], and the transparency changes reversibly depending on temperature.

[0021] Next, although informational record or informational elimination is made by two-layer coincidence with the heating means using a laser beam unless the thermal recording temperature of the first heat-sensitive recording layer and the second heat-sensitive recording layer is sharply different in the thermal recording medium concerning invention according to claim 1 to 3 Between a light-and-heat conversion layer and the second heat-sensitive recording layer, for example, when the thermal break which consisted of resin with low thermal conductivity like polyester resin is made to intervene, Since it propagation-comes to be hard of the heat produced in the light-and-heat conversion layer to the second heat-sensitive recording layer with a thermal break, it becomes possible [recording or eliminating information only to the first heat-sensitive recording layer]. Invention concerning claim 4 is made for such a reason for technical.

[0022] That is, invention concerning claim 4 is characterized by the thermal break

intervening between a light-and-heat conversion layer and the second heat-sensitive recording layer on the assumption that a thermal recording medium according to claim 1, 2, or 3.

[0023] Next, although it has the composition that the first heat-sensitive recording layer and second heat-sensitive recording layer were prepared through the light-and-heat conversion layer in the thermal recording medium concerning invention according to claim 1 to 4 in between Even if it makes it the configuration which established a light-and-heat conversion layer, the first irreversible heat-sensitive recording layer, and the second reversible heat-sensitive recording layer in order from the base material side, the thermal recording medium concerning invention according to claim 1 to 4 and the thermal recording medium which has the same function can be obtained. since [however,] the first heat-sensitive recording layer which adjoins a light-and-heat conversion layer compared with the second heat-sensitive recording layer located in a front-face side is heated more by the elevated temperature when a laser beam is irradiated -- the thermal recording temperature of both heat-sensitive recording layers -- abbreviation -- when equal, coincidence record of both heat-sensitive recording layers becomes difficult. On the other hand, in case information is recorded on the second heat-sensitive recording layer with the heating means using a thermal head, since a light-and-heat conversion layer does not intervene between the first heat-sensitive recording layer and the second heat-sensitive recording layer, the case where informational record is made also in the first heat-sensitive recording layer arises. Invention concerning claim 5 is made for such a reason for technical.

[0024] Namely, the light-and-heat conversion layer which invention concerning claim 5 uses as a principal component the light absorption agent distributed in resin and this resin, absorbs light on a base material, and generates heat, Sequential formation of the first irreversible heat-sensitive recording layer and the second heat-sensitive recording layer where the organic low-molecular matter distributed in resin and this resin is used as a principal component, and the transparency changes reversibly depending on temperature is carried out. And

thermal recording temperature of the first heat-sensitive recording layer of the above is characterized by being an elevated temperature from the thermal recording temperature of the second heat-sensitive recording layer.

[0025] In the thermal recording medium concerning invention according to claim 5 And since the thermal recording temperature of the first heat-sensitive recording layer is higher than the thermal recording temperature of the second heat-sensitive recording layer, Even if a laser beam is irradiated and whenever [stoving temperature / of the first heat-sensitive recording layer] becomes higher than whenever [stoving temperature / of the second heat-sensitive recording layer], coincidence record of both heat-sensitive recording layers is possible. And even if the heating means using a thermal head performs informational record or informational elimination to the second heat-sensitive recording layer, it is not thermal influenced [the] in the first heat-sensitive recording layer where the thermal recording temperature is higher than the second heat-sensitive recording layer.

[0026] In addition, when a light absorption agent is added in the first heat-sensitive recording layer in the thermal recording medium concerning invention according to claim 5, this first heat-sensitive recording layer will serve as a light-and-heat conversion layer. Invention concerning claim 6 is made from such a reason for technical.

[0027] Namely, the first irreversible heat-sensitive recording layer where, as for invention concerning claim 6, the light absorption agent was added on the base material, Sequential formation of the second heat-sensitive recording layer where the organic low-molecular matter distributed in resin and this resin is used as a principal component, and the transparency changes reversibly depending on temperature is carried out. And thermal recording temperature of the first heat-sensitive recording layer of the above is characterized by being an elevated temperature from the thermal recording temperature of the second heat-sensitive recording layer.

[0028] Moreover, also when the thermal break which consisted of resin with low

thermal conductivity like polyester resin is made to intervene like invention concerning claim 4 between the first heat-sensitive recording layer and the second heat-sensitive recording layer, it becomes possible to record information only on the first heat-sensitive recording layer by the heating means which used the laser beam. Invention concerning claim 7 is made from such a reason for technical.

[0029] That is, invention concerning claim 7 is characterized by the thermal break intervening between the first heat-sensitive recording layer and the second heat-sensitive recording layer on the assumption that the thermal recording medium concerning invention according to claim 5 or 6.

[0030] As a resin ingredient which constitutes a part of reversible heat-sensitive recording layer in such technical means While the organic low-molecular matter described below and its refractive index approximate and there is no compatibility The thermoplastics with good transparency which is excellent in a mechanical strength and moreover has film organization potency is mentioned. as the example -- polyester resin [, such as saturation copolymerized polyester,]; -- polyvinyl chloride resin; -- a vinyl chloride vinyl acetate copolymer -- A vinyl chloride-vinyl acetate-vinyl alcohol copolymer, a vinyl chloride-vinyl acetate-maleic-acid copolymer, vinyl chloride copolymers [, such as a vinyl chloride-acrylate copolymer,]; -- polyvinylidene chloride resin; -- a vinylidene-chloride-vinyl chloride copolymer -- vinylidene-chloride copolymers [, such as a vinylidene-chloride-acrylonitrile copolymer,]; -- polyamide resin; -- silicon resin; -- polyacrylate, polymethacrylate resin, or these copolymers -- it is -- these -- independent -- or two or more sorts can be mixed and it can apply. moreover, as organic low-molecular matter distributed in this resin ingredient A carbon number is [the molecular weight] 100-700 in 10-40 including at least one atom among oxygen, sulfur, nitrogen, and a halogen. The organic compound in the range whose melting point is 50-150 degrees C is mentioned. As the example And alkanol, Higher-alcohol; high-class fatty amines, such as cull can diol, halogen alkanol, and halogen alkane diol; An alkane, An alkene, alkynes, and these

halogenation objects; Cycloalkane, Ring compounds, such as cycloalkene and cycloalkyne; A saturation carboxylic acid, Partial saturation monocarboxylic acid, dicarboxylic acid or these ester, an amide, Ammonium salt; Saturation, partial saturation halogen fatty acids, or these ester, An amide, ammonium salt; Acrylic carboxylic acids or these ester, An amide, ammonium salt; Halogen allyl compound carboxylic acids or these ester, an amide, ammonium salt; thioalcohols, these carboxylate; thiocarboxylic acids or these ester, an amide, ammonium salt, etc. -- it is -- these -- independent -- or two or more sorts can be mixed and it can apply.

[0031] Moreover, as a base material which supports a heat-sensitive recording layer etc., cards, such as sheets, such as paper, polyethylene terephthalate, polyethylenenaphthalate, and a polycarbonate, and a vinyl chloride, etc. are mentioned, and vacuum deposition etc. forms suitably light reflex nature metal layers, such as aluminum, tin, silver, magnesium, chromium, and nickel, with a film production means, or on this base material, coloring layers with which the coloring agent was blended suitably, such as carbon, are formed, and it is applied, for example.

[0032]

[Function] Since according to the thermal recording medium concerning invention according to claim 1 it has the first heat-sensitive recording layer and second heat-sensitive recording layer through a light-and-heat conversion layer and the above-mentioned light-and-heat conversion layer functions as a thermal break according to an operation of the resinous principle, it becomes possible to perform informational high-speed record or informational elimination with the heating means using a thermal head only to the second heat-sensitive recording layer located in a front-face side.

[0033] Moreover, when informational write-in actuation is performed by the heating means using a laser beam, since the heat generated from the above-mentioned light-and-heat conversion layer gets across to the first heat-sensitive recording layer and second heat-sensitive recording layer almost equally, unless

the thermal recording temperature of both heat-sensitive recording layers is sharply different, it becomes possible [performing informational record or informational elimination to two-layer coincidence].

[0034] Furthermore, about the information recorded on the first heat-sensitive recording layer, it also becomes possible to aim at an improvement of alteration / forged prevention property in a thermal recording medium according to an operation of the above-mentioned light-and-heat conversion layer, since informational rewriting or informational elimination by the thermal head is difficult.

[0035] Next, since according to the thermal recording medium concerning invention according to claim 2 the first heat-sensitive recording layer of the above consists of irreversible thermal recording ingredients and can write in the information which is not eliminable to this first heat-sensitive recording layer, it becomes possible to aim at further an improvement of the above-mentioned alteration / forged prevention property.

[0036] Moreover, according to the thermal recording medium concerning invention according to claim 3, it consists of reversible thermal recording ingredients from which the organic low-molecular matter with which the first heat-sensitive recording layer of the above was distributed in resin and this resin is used as a principal component, and the transparency changes reversibly depending on temperature. Since the first heat-sensitive recording layer and second heat-sensitive recording layer consist of [both] reversible thermal recording ingredients and the same recording information is recordable to both heat-sensitive recording layers with the heating means using a laser beam, Since a problem is not produced in whenever [nebula] and thickness becomes half even if it sets each record layer thickness as the conventional one half, it also becomes possible to reduce the output of a laser beam which carries out a part exposure.

[0037] Moreover, according to the thermal recording medium concerning invention according to claim 4, the thermal break intervenes between a light-and-heat conversion layer and the second heat-sensitive recording layer, and since it

propagation-comes to be hard of the heat produced in the above-mentioned light-and-heat conversion layer to the second heat-sensitive recording layer with a thermal break, it becomes possible [performing informational record or informational elimination only to the first heat-sensitive recording layer with the heating means using a laser beam].

[0038] Next, the light-and-heat conversion layer which according to the thermal recording medium concerning invention according to claim 5 uses as a principal component the light absorption agent distributed in resin and this resin, absorbs light, and generates heat on a base material, Sequential formation of the first irreversible heat-sensitive recording layer and the second heat-sensitive recording layer where the organic low-molecular matter distributed in resin and this resin is used as a principal component, and the transparency changes reversibly depending on temperature is carried out. And since the thermal recording temperature of the first heat-sensitive recording layer of the above is an elevated temperature from the thermal recording temperature of the second heat-sensitive recording layer, Even if a laser beam is irradiated and whenever [stoving temperature / of the first heat-sensitive recording layer] becomes higher than whenever [stoving temperature / of the second heat-sensitive recording layer], coincidence record of both heat-sensitive recording layers is possible. And even if the heating means using a thermal head performs informational record or informational elimination to the second heat-sensitive recording layer, it is not thermal influenced [the] in the first heat-sensitive recording layer where the thermal recording temperature is higher than the second heat-sensitive recording layer.

[0039] Moreover, the first irreversible heat-sensitive recording layer where the light absorption agent was added on the base material according to the thermal recording medium concerning invention according to claim 6, Sequential formation of the second heat-sensitive recording layer where the organic low-molecular matter distributed in resin and this resin is used as a principal component, and the transparency changes reversibly depending on temperature

is carried out, and since the light absorption agent is added in the first heat-sensitive recording layer, it becomes possible to omit formation of a light-and-heat conversion layer.

[0040] Moreover, since the thermal recording temperature of the first heat-sensitive recording layer of the above is an elevated temperature from the thermal recording temperature of the second heat-sensitive recording layer, Even if a laser beam is irradiated and whenever [stoving temperature / of the first heat-sensitive recording layer] becomes higher than whenever [stoving temperature / of the second heat-sensitive recording layer] like the thermal recording medium concerning claim 5, coincidence record of both heat-sensitive recording layers is possible. And even if the heating means using a thermal head performs informational record or informational elimination to the second heat-sensitive recording layer, it is not thermal influenced [the] in the first heat-sensitive recording layer where the thermal recording temperature is higher than the second heat-sensitive recording layer.

[0041] Moreover, according to the thermal recording medium concerning invention according to claim 7, the thermal break intervenes between the first heat-sensitive recording layer and the second heat-sensitive recording layer, and since it propagation-comes to be hard of the heat produced in the first heat-sensitive recording layer of the above to the second heat-sensitive recording layer with a thermal break, it becomes possible [recording information only to the first heat-sensitive recording layer with the heating means using a laser beam] like the thermal recording medium concerning claim 4.

[0042]

[Example] Hereafter, the example of this invention is explained to a detail with reference to a drawing.

[0043] [Example 1] the thermal recording medium concerning this example The base material 1 which consists of paper, the sheet of polyethylene terephthalate, the card of a vinyl chloride, etc. as shown in drawing 1 , The aluminum layer 2 prepared on this base material 1, and the first heat-sensitive recording layer 3

prepared on this aluminum layer 2, The light-and-heat conversion layer 4 prepared on this first heat-sensitive recording layer 3, and the second heat-sensitive recording layer 5 which it is prepared on this light-and-heat conversion layer 4, and optical density changes depending on the temperature at the time of record, and can perform record and elimination reversibly, That principal part consists of protective layers 6 prepared on this second heat-sensitive recording layer 5.

[0044] Hereafter, the manufacture approach of this thermal recording medium A is explained.

[0045] First, the aluminum layer 2 of 50-100nm thickness is formed by vacuum evaporationo on the above-mentioned base material 1.

[0046] Next, the first heat-sensitive recording layer 3 may be irreversible, and a recordable irreversible heat-sensitive recording layer is sufficient as it also in the reversibility heat-sensitive recording layer which can perform record and elimination reversibly if it is the matter which colors by heating. for example, as the above-mentioned reversibility heat-sensitive recording layer What forms a visible image is applicable from the difference of the transparence condition which uses as a principal component organic low-molecular matter, such as a higher fatty acid distributed by thermoplastics and these resin, such as a polyvinyl chloride indicated by JP,55-154198,A, and is produced with the attainment temperature at the time of record, and a nebula condition. On the aluminum layer 2, with spreading means, such as a wire bar, the dispersion liquid of this reversibility record ingredient are applied to the thickness of 6.0-10.0 micrometers, and can be formed. 7:3 mixes comparatively (volume ratio) the developer dispersion liquid which a styrene acrylic is underwater distributed as a phenol system developer and a binder, and change as the above-mentioned irreversible heat-sensitive recording layer on the other hand, for example, and the color coupler dispersion liquid which a leuco color is underwater distributed as a color coupler, and change, and with spreading means, such as a wire bar, on the aluminum layer 2, this is applied to the thickness of 3.0 micrometers and

can be formed.

[0047] Moreover, the second heat-sensitive recording layer 5 of the above consists of reversible thermal recording ingredients. For example, what forms a visible image is applicable from the difference of the transparence condition which uses as a principal component organic low-molecular matter, such as a higher fatty acid distributed by thermoplastics and these resin, such as a polyvinyl chloride indicated by JP,55-154198,A, and is produced with the attainment temperature at the time of record, and a nebula condition. On the aluminum layer 2, with spreading means, such as a wire bar, the dispersion liquid of this reversibility record ingredient are applied to the thickness of 6.0-10.0 micrometers, and can be formed.

[0048] Furthermore, the above-mentioned protective layer 6 can apply and form what distributed heat-resistant and wear-resistant good resin (for example, fluorine system resin, silicone system resin, etc.) in the solvent with spreading means, such as a wire bar, on the second heat-sensitive recording layer 5 like the thermal recording medium concerning the conventional example. In addition, the thickness of a protective layer 6 is thinly set up with about 3.0-5.0 micrometers, in order to enable it to record and eliminate the second heat-sensitive recording layer 5 by the thermal head.

[0049] Thus, information record / elimination property of the manufactured thermal recording medium A is explained below.

[0050] Drawing 2 is the block block diagram of the information record and the eraser for recording and eliminating information at the thermal recording medium A. The thermal recording medium A is laid on the conveyance device 7 which can be conveyed in the direction of Y. The thermal head 8 is formed so that the top face may be touched. Sequential connection of the thermal head 8 is made at the power source 9 for a drive, and the control unit 10. On the other hand, it is each other in a thermal recording medium A top face in ****, the galvanomirror 11 which can be scanned in the direction of X is arranged, and sequential installation of the condensing optical system 12 and the laser diode 13 is carried

out on the same optical axis as this galvanomirror 11. Sequential connection of the laser diode 13 is made at the driver 14 and the control unit 10.

[0051] The thermal recording medium A is conveyed in the direction of Y according to the conveyance device 7. The power according to the control signal which a control unit 10 emits is applied to a thermal head 8 from the power source 9 for a drive. The heat generated from the thermal head 8 arrives at the second heat-sensitive recording layer 5 through the protective layer 6 of the thermal recording medium A. Since the thickness of a protective layer 6 is as thin as about 3.0 micrometers, the second heat-sensitive recording layer 5 is heated by even sufficient temperature for record and elimination. The second heat-sensitive recording layer 5 is constituted by the reversibility thermal recording ingredient, and the recording characteristic has the relation of attainment temperature and optical density as shown in the graphical representation of drawing 3 . Attainment temperature is the peak temperature which the second heat-sensitive recording layer 5 reached at the time of record / elimination actuation, and is the temperature T1 here. T2 If it is in the middle, the second heat-sensitive recording layer 5 will be in the transparence condition that optical density is high, even after falling in a room temperature. On the contrary, attainment temperature is T2. When it is above, the second heat-sensitive recording layer 5 will be in the low nebula condition of optical density. Temperature T1 T2 It can set up freely in 60-120 degrees C, and it can be decided that record / elimination condition becomes the optimal. Since, as for the heat generated from the thermal head, the light-and-heat conversion layer 4 is using resin with low thermal conductivity as the principal component, it seldom gets across to the first heat-sensitive recording layer 3 according to the heat insulation operation, and record does not have a line crack in the first heat-sensitive recording layer 3. Therefore, a thermal head can perform record and elimination only to the second heat-sensitive recording layer 5.

[0052] On the other hand, the above-mentioned laser diode 13 emits light with the power supplied from a driver 14 according to the control signal from a control

unit 10. A laser beam reaches the thermal recording medium A through the condensing optical system 12 and a galvanomirror 11. Furthermore, a laser beam penetrates the protective layer 6 of the thermal recording medium A, and the second heat-sensitive recording layer 5, condenses within the light-and-heat conversion layer 4, and is changed into heat from light. The heat generated from the light-and-heat conversion layer 4 gets across to homogeneity mostly in the first heat-sensitive recording layer 3 and second heat-sensitive recording layer 5. Drawing 4 is the sectional view having shown the temperature distribution produced in the cross section of the first heat-sensitive recording layer 3, the light-and-heat conversion layer 4, and the second heat-sensitive recording layer 5 at this time, and if the constant-temperature line T is seen, the almost same temperature distribution will be formed in the first heat-sensitive recording layer 3 and second heat-sensitive recording layer 5 so that clearly. Therefore, when both the heat-sensitive recording layers 3 and 5 color at the same temperature, it can record on two-layer coincidence (namely, when the thermal recording temperature of both heat-sensitive recording layers is abbreviation identitas).

[0053] Thus, only the second heat-sensitive recording layer 5 can be recorded and eliminated by the thermal head 8, and it can record by the laser beam at coincidence on both the first heat-sensitive recording layer 3 and the second heat-sensitive recording layer 5. Therefore, while recording information which is immediately eliminated according to the property of the information to record only on the second heat-sensitive recording layer 5 by the thermal head 8, it should just be made to carry out coincidence record by the laser beam in the first heat-sensitive recording layer 3 and second heat-sensitive recording layer 5 about important information which is concerned with security. Record and elimination of efficient information are possible by using the recording layer according to the property of such information properly.

[0054] For example, since the information recorded only on the second heat-sensitive recording layer 5 is easily eliminable by the thermal head 8, as compared with the reversibility thermal recording medium for laser beam thermal

recording concerning the conventional example record and whose elimination were not completed, record and elimination of high-speed information are possible for it only at a laser beam. Moreover, with the heat from a thermal head 8 or the outside, as for the information which carried out coincidence record, only the second heat-sensitive recording layer 5 is eliminated by the first heat-sensitive recording layer 3 and second heat-sensitive recording layer 5, but the information on the first heat-sensitive recording layer 3 is left behind. Therefore, it is possible to prevent the informational disappearance, and the alteration and forgery by the heat from the outside. About the first heat-sensitive recording layer 3 which exists in the bottom in the anticipated-use condition especially since information is always recorded on the second heat-sensitive recording layer 5 also by record by which of a thermal head 8 or a laser beam, it is hard to be noticed. Furthermore, if dummy information is recorded on the second heat-sensitive recording layer 5 which hits the upper part of the information on the first heat-sensitive recording layer 3 which once eliminated the information on the second heat-sensitive recording layer 5 to the first heat-sensitive recording layer 3 and second heat-sensitive recording layer 5 by the thermal head 8, and remained in them after carrying out coincidence record by the laser beam by the thermal head 8, the information recorded on the first heat-sensitive recording layer 3 can be hidden. In addition, in order to read the information recorded on the first heat-sensitive recording layer 3, it becomes possible by setting the second heat-sensitive recording layer 5 as a transparence condition with the heating means using a thermal head. Therefore, as compared with various kinds of thermal recording media concerning the conventional example, security nature has a high advantage far.

[0055] Moreover, when the first heat-sensitive recording layer 3 is constituted from an irreversible thermal recording ingredient in this example, the information which is not eliminable to this first heat-sensitive recording layer 3 can be written in, and it becomes possible to raise security nature further.

[0056] Next, the thermal recording medium by which the first heat-sensitive

recording layer 3 of the above consists of reversible thermal recording ingredients like the first heat-sensitive recording layer 5 as a modification of this example is explained. That is, in this thermal recording medium, about the thickness of the above-mentioned protective layer 6, it is set as 5.0 micrometers or more so that thickness of the first heat-sensitive recording layer 3 and the second heat-sensitive recording layer 5 may be set to one half of the thermal recording media concerning 3.0-5.0 micrometers and the above-mentioned example, respectively, and it may be set as the thickness of 6.0-10.0 micrometers by both the heat-sensitive recording layers 3 and the 5 whole and record and elimination can be performed only in a laser beam.

[0057] Record / elimination property by the laser beam of the thermal recording medium concerning this modification is explained as compared with the reversibility thermal recording medium concerning the conventional example equipped only with the single heat-sensitive recording layer. Drawing 5 and drawing 6 are the outline sectional views showing the temperature distribution produced when the laser beam of the same energy is irradiated to the thermal recording medium concerning the modification which formed both the heat-sensitive recording layers 3 and 5, respectively, and the reversibility thermal recording medium concerning the conventional example equipped only with the single heat-sensitive recording layer 102. Although the same temperature distribution as abbreviation are formed focusing on the light-and-heat conversion layer 4,104 so that clearly if the constant-temperature line T of drawing 5 and drawing 6 is seen, it can check that the area of a shadow area which has reached temperature recordable since the locations of the light-and-heat conversion layer 4,104 differ differs greatly. In the thermal recording medium concerning the modification shown in drawing 5 , completely recordable temperature is reached to having not reached completely recordable temperature to the upper front face of a heat-sensitive recording layer 102 in the thermal recording medium concerning the conventional example shown in drawing 6 from the following table side of both the heat-sensitive recording layers 3 and 5 to the

upper front face.

[0058] And when it is going to perform perfect record in the above-mentioned thermal recording medium concerning the conventional example, it is necessary to make reinforcement of a laser beam still higher, and then, since the heat-sensitive recording layer 102 lower part of the light-and-heat conversion layer 104 neighborhood becomes an elevated temperature exceeding 200 degrees C, the thermal runaway of a heat-sensitive recording layer becomes easy to produce it. He can understand that image quality can record good information or a good image by the laser beam of low energy more from the thermal recording medium applied to the conventional example in the thermal recording medium concerning a modification from this. Moreover, since, as for a laser diode, a price will rise abruptly if an output becomes large, big effectiveness also produces reduction of record energy economically.

[0059] [Example 2] the thermal recording medium concerning this example The aluminum layer 2 prepared on a base material 1 and this base material 1 as shown in drawing 7 , The first heat-sensitive recording layer 15 which is prepared on the light-and-heat conversion layer 4 prepared on this aluminum layer 2, and this light-and-heat conversion layer 4, and consists of an irreversible thermal recording ingredient, It is prepared on this first heat-sensitive recording layer 15, optical density changes depending on the temperature at the time of record, and that principal part consists of record, the second heat-sensitive recording layer 5 which can perform elimination reversibly, and a protective layer 6 prepared on this second heat-sensitive recording layer 5.

[0060] Here, the first heat-sensitive recording layer 15 of the above mix the developer dispersion liquid which a styrene acrylic be underwater distribute as for example, a phenol system developer and a binder, and change, and the color coupler dispersion liquid which a leuco color be underwater distribute as a color coupler, and change at a rate of 7:3, and this be apply to the thickness of 3.0 micrometers on the light and heat conversion layer 4 with spreading means, such as a wire bar, it have the form, and the coloring temperature be 150 degrees C or

more. On the other hand, the nebula record temperature of the second heat-sensitive recording layer 5 which consists of same ingredients as an example 1 is 100 degrees C or more, and has the low value compared with the coloring temperature of the first heat-sensitive recording layer 15. In addition, since components other than the first heat-sensitive recording layer 15 are the same as that of an example 1, explanation is omitted.

[0061] And if a laser beam is irradiated to the thermal recording medium concerning this example, this laser beam is changed into heat in the light-and-heat conversion layer 4, and gets across to the first heat-sensitive recording layer 15 and the second heat-sensitive recording layer 5 one by one. Although the direction of the first heat-sensitive recording layer 15 with the temperature distribution near the light-and-heat conversion layer 4 naturally becomes an elevated temperature, since the first heat-sensitive recording layer 15 is constituted by the irreversible thermal recording ingredient which used the leuco color etc. as the principal component, the coloring temperature is as high [the heat-sensitive recording layer] as 150 degrees C or more, as mentioned above. On the other hand, the second heat-sensitive recording layer 5 consists of reversible thermal recording ingredients, and 100 degrees C or more and since the nebula record temperature is low, coincidence record of both the heat-sensitive recording layers 5 and 15 is possible [the heat-sensitive recording layer] for it.

[0062] On the other hand, since record will be possible in the case of record by the thermal head if the inferior surface of tongue of the second heat-sensitive recording layer 5 becomes 100 degrees C or more, then, the first heat-sensitive recording layer 15 reaches coloring temperature, and is not recorded on coincidence.

[0063] Therefore, the coincidence record of the record and elimination only to the second heat-sensitive recording layer 5, the first heat-sensitive recording layer 15 by the laser beam, and the second heat-sensitive recording layer 5 by the thermal head is possible like the thermal recording medium concerning an

example 1.

[0064] [Example 3] the thermal recording medium concerning this example The aluminum layer 2 prepared on a base material 1 and this base material 1 as shown in drawing 8 , The first heat-sensitive recording layer 16 which consists of the irreversible thermal recording ingredient with which it was prepared on this aluminum layer 2, and the light absorption agent was added, It is prepared on this first heat-sensitive recording layer 16, optical density changes depending on the temperature at the time of record, and that principal part consists of record, the second heat-sensitive recording layer 5 which can perform elimination reversibly, and a protective layer 6 prepared on this second heat-sensitive recording layer 5. In addition, the light absorption agent added all over the first heat-sensitive recording layer 16 should just choose what has an absorption property corresponding to the wavelength of the laser beam to be used. For example, a near-infrared absorbent like a phthalocyanine is used in infrared semiconductor laser.

[0065] And it sets to the thermal recording medium concerning this example. Since the first heat-sensitive recording layer 16 where the light absorption agent was added is made to combine the conversion function to heat, and absorption of a laser beam in an irreversible thermal recording functional list, In spite of not having the light-and-heat conversion layer, the record and elimination only to the second heat-sensitive recording layer 5, and the coincidence record of the first heat-sensitive recording layer 16 and the second heat-sensitive recording layer 5 by the laser beam by the thermal head are attained like the thermal recording medium concerning an example 2. Moreover, in this thermal recording medium, in order not to require the light-and-heat conversion layer 4 compared with the thermal recording medium concerning examples 1 and 2, it has the advantage which that part and the spreading number of layers at the time of manufacture decrease, and can aim at reduction of a production process.

[0066] Although the record by the laser beam has the composition that the first heat-sensitive recording layer and second heat-sensitive recording layer are

surely performed to coincidence, in the examples 1-3 mentioned above, it may be more desirable not to perform coincidence record depending on an application. In such a case, it is possible to cope with it by preparing the thermal break which isolates thermally the first heat-sensitive recording layer and second heat-sensitive recording layer.

[0067] Namely, it considers as the configuration between which a thermal break 17 is made to be placed in the thermal recording medium concerning an example 1 between the light-and-heat conversion layer 4 and second heat-sensitive recording layer 5 (refer to drawing 9). It considers as the configuration between which a thermal break 17 is made to be placed in the thermal recording medium concerning an example 2 between the first heat-sensitive recording layer 15 and the second heat-sensitive recording layer 5 (refer to drawing 10). Moreover, it is possible to cope with it by making it the configuration (referring to drawing 10) between which a thermal break 17 is made to be placed in the thermal recording medium concerning an example 3 between the first heat-sensitive recording layer 16 and the second heat-sensitive recording layer 5. In addition, as the above-mentioned thermal break 17, resin with low thermal conductivity like polyester resin is applicable, for example.

[0068] Although the heat generated from the light-and-heat conversion layer 4 or the first heat-sensitive recording layer 16 gets across to the first heat-sensitive recording layer 3, 15, and 16, the above-mentioned thermal break 17 acts to the second heat-sensitive recording layer 5, and it stops and getting across to it not much, when it was made such a configuration and a laser beam is irradiated to a thermal recording medium. Therefore, record will be performed only to the first heat-sensitive recording layer 3, 15, and 16 at the time of the exposure of a laser beam. That is, the first heat-sensitive recording layer 3, 15, and 16 becomes only for the thermal recording by the laser beam, and can make the second heat-sensitive recording layer 5 only for the thermal recording by the thermal head.

[0069]

[Effect of the Invention] According to invention concerning claim 1, the heating

means using a thermal head can perform informational high-speed record or informational elimination only to the second heat-sensitive recording layer located in a front-face side. And while the heating means using a laser beam can perform informational record or informational elimination to coincidence to the first heat-sensitive recording layer and second heat-sensitive recording layer About the information recorded on the first heat-sensitive recording layer, informational rewriting or informational elimination by the thermal head becomes difficult according to a heat insulation operation of the resin ingredient which constitutes a part of light-and-heat conversion layer.

[0070] Therefore, since high record of security nature like the coincidence record to both the heat-sensitive recording layers by the laser beam is extremely realizable if needed, maintaining the rapidity of the record and elimination by the thermal head, record and elimination have the effectiveness that a high speed, record of the information which is easy and was moreover excellent in alteration / forged tightness, and elimination can be performed.

[0071] Next, since according to invention concerning claim 2 the first heat-sensitive recording layer consists of irreversible thermal recording ingredients and can write in the information which is not eliminable to this first heat-sensitive recording layer, it has the effectiveness that an improvement of alteration / forged prevention property can be aimed at further.

[0072] Moreover, since according to invention concerning claim 3 the first heat-sensitive recording layer and second heat-sensitive recording layer consist of [both] reversible thermal recording ingredients and the same recording information is recordable to both heat-sensitive recording layers with the heating means using a laser beam, Since a problem is not produced in whenever [nebula] and thickness becomes half even if it sets each record layer thickness as the conventional one half, it has the effectiveness that the output of a laser beam which carries out a part exposure can be reduced.

[0073] Moreover, since the heat which the thermal break intervened between a light-and-heat conversion layer and the second heat-sensitive recording layer,

and was produced in the above-mentioned light-and-heat conversion layer propagation-comes to be hard to the second heat-sensitive recording layer with this thermal break according to invention concerning claim 4, it has the effectiveness that the heating means using a laser beam can perform informational record or informational elimination only to the first heat-sensitive recording layer.

[0074] Next, since the thermal recording temperature of the first heat-sensitive recording layer is an elevated temperature from the thermal recording temperature of the second heat-sensitive recording layer according to invention concerning claim 5, Even if a laser beam is irradiated and whenever [stoving temperature / of the first heat-sensitive recording layer] becomes higher than whenever [stoving temperature / of the second heat-sensitive recording layer], coincidence record of both heat-sensitive recording layers is possible. And even if the heating means using a thermal head performs informational record or informational elimination to the second heat-sensitive recording layer, it is not thermal influenced [the] in the first heat-sensitive recording layer where the thermal recording temperature is higher than the second heat-sensitive recording layer.

[0075] Therefore, record and elimination have the effectiveness that a high speed, record of the information which is easy and was moreover excellent in alteration / forged tightness, and elimination can be performed, like the thermal recording medium concerning claims 1-4.

[0076] Moreover, since the light absorption agent is added in the first heat-sensitive recording layer, while formation of a light-and-heat conversion layer is omissible according to invention concerning claim 6, record and elimination have the effectiveness that a high speed, record of the information which is easy and was moreover excellent in alteration / forged tightness, and elimination can be performed.

[0077] Moreover, according to invention concerning claim 7, since it propagation-comes to be hard of the heat which the thermal break intervened between the

first heat-sensitive recording layer and the second heat-sensitive recording layer, and was produced in the first heat-sensitive recording layer of the above to the second heat-sensitive recording layer with a thermal break, it has the effectiveness which can record information only to the first heat-sensitive recording layer with the heating means using a laser beam like the thermal recording medium concerning claim 4.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The sectional view showing the configuration of the thermal recording medium concerning an example 1.

[Drawing 2] The block block diagram of the record and the eraser used in the example.

[Drawing 3] The graphical representation showing the relation between the attainment temperature of a reversibility thermal recording ingredient, and optical density.

[Drawing 4] The sectional view showing the temperature distribution at the time of record of the thermal recording medium concerning an example 1.

[Drawing 5] The sectional view showing the temperature distribution at the time of record of the thermal recording medium concerning a modification.

[Drawing 6] The sectional view showing the temperature distribution at the time of record of the thermal recording medium concerning the conventional example.

[Drawing 7] The sectional view showing the configuration of the thermal recording medium concerning an example 2.

[Drawing 8] The sectional view showing the configuration of the thermal recording medium concerning an example 3.

[Drawing 9] The sectional view showing the configuration of the thermal

recording medium concerning the modification of an example 1.

[Drawing 10] The sectional view showing the configuration of the thermal recording medium concerning the modification of an example 2.

[Drawing 11] The sectional view showing the configuration of the thermal recording medium concerning the modification of an example 3.

[Drawing 12] The sectional view showing the configuration of the thermal recording medium concerning the conventional example.

[Drawing 13] The sectional view showing the configuration of the thermal recording medium concerning other conventional examples.

[Description of Notations]

A Thermal recording medium

1 Base Material

2 Aluminum Layer

3 First Heat-sensitive Recording Layer

4 Light-and-Heat Conversion Layer

5 Second Heat-sensitive Recording Layer

6 Protective Layer

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(71)出願人　000003193
凸版印刷株式会社
東京都台東区台東１丁目５番１号

(72)発明者　飯野　良一
東京都台東区台東一丁目５番１号　凸版印刷株式会社内

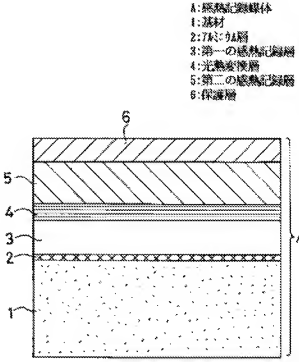
(74)代理人　弁理士　上田　章三

(54)【発明の名称】　感熱記録媒体

(57)【要約】

【目的】　高速・高画質の記録が可能で、情報の変更・修正が容易であると共に、改ざん・偽造防止特性が良好な感熱記録媒体を提供する。

【構成】　この感熱記録媒体Ａは、基材１と、この基材１上に設けられたアルミニウム層２と、このアルミニウム層２上に設けられた第一の感熱記録層３と、この第一の感熱記録層３上に設けられた光熱変換層４と、この光熱変換層４上に設けられ記録時の温度に依存して光学濃度が変化し記録と消去が可逆的に行える第二の感熱記録層５と、この第二の感熱記録層５上に設けられた保護層６とでその主要部が構成されている。そして、第二の感熱記録層に対してのみサーマルヘッドを用いた加熱手段により情報の高速記録若しくは消去が行え、かつ、レーザ光を用いた加熱手段により第一の感熱記録層と第二の感熱記録層に対し同時に情報の記録若しくは消去が行える。



【特許請求の範囲】

【請求項1】基材上に、第一の感熱記録層と、樹脂と該樹脂中に分散された光吸収剤を主成分とし光を吸収して熱を発生する光熱変換層と、樹脂と該樹脂中に分散された有機低分子物質を主成分とし温度に依存してその透明度が可逆的に変化する第二の感熱記録層とが順次形成されていることを特徴とする感熱記録媒体。

【請求項2】上記第一の感熱記録層が、不可逆性の感熱記録材料で構成されていることを特徴とする請求項1記載の感熱記録媒体。

【請求項3】上記第一の感熱記録層が、樹脂と該樹脂中に分散された有機低分子物質を主成分とし温度に依存してその透明度が可逆的に変化する可逆性の感熱記録材料で構成されていることを特徴とする請求項1記載の感熱記録媒体。

【請求項4】上記光熱変換層と第二の感熱記録層との間に断熱層が介在していることを特徴とする請求項1、2又は3記載の感熱記録媒体。

【請求項5】基材上に、樹脂と該樹脂中に分散された光吸収剤を主成分とし光を吸収して熱を発生する光熱変換層と、不可逆性の第一の感熱記録層と、樹脂と該樹脂中に分散された有機低分子物質を主成分とし温度に依存してその透明度が可逆的に変化する第二の感熱記録層とが順次形成されており、かつ、上記第一の感熱記録層の感熱記録温度が第二の感熱記録層の感熱記録温度より高温であることを特徴とする感熱記録媒体。

【請求項6】基材上に、光吸収剤が添加された不可逆性の第一の感熱記録層と、樹脂と該樹脂中に分散された有機低分子物質を主成分とし温度に依存してその透明度が可逆的に変化する第二の感熱記録層とが順次形成されており、かつ、上記第一の感熱記録層の感熱記録温度が第二の感熱記録層の感熱記録温度より高温であることを特徴とする感熱記録媒体。

【請求項7】上記第一の感熱記録層と第二の感熱記録層との間に断熱層が介在していることを特徴とする請求項5又は6記載の感熱記録媒体。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、サーマルヘッド及びレーザ光により記録可能な感熱記録媒体に係り、特に、高速・高画質の記録が可能で、情報の変更・修正が容易であると共に、改ざん・偽造防止特性が良好な感熱記録媒体に関するものである。

【０００２】

【従来の技術】従来から、感熱記録方式は、ワードプロセッサ、パーソナルコンピュータ等の出力手段として、また、ハイウェイカード、イオカード（ＪＲ発売）等各種プリペードカードへの情報記録手段として広く利用されている。これら感熱記録に使用される記録媒体としては、記録のみ可能で一度記録すると消去不可能な不可逆性のものが主流を占めている。

【０００３】ところで、上記フリペードカード等の金券においては感熱記録によって使用金額の合計や残額の表示を行っている。そして、これらは使用状況に応じて変化する数字であることから、記録されている情報を消去して再度記録することができない感熱記録媒体では、利用回数が増えるに伴い利用明細の書き込みスペースがなくなってしまうため新たな情報の記録が困難となる欠点があった。

【０００４】そこで、近年、可逆性の感熱記録材料及びこれを基材上に積層した可逆性の感熱記録媒体に関し数多くの提案がなされている。

【０００５】上記可逆性の感熱記録媒体への情報の記録は、多くの場合サーマルヘッドにより行われている。図１２は従来例に係るサーマルヘッド用の可逆性感熱記録媒体の断面図を示しており、この感熱記録媒体Ａは、紙や樹脂等の基材１００上にアルミニウム蒸着層１０１、可逆性感熱記録層１０２、保護層１０３が順次積層された構成となっている。そして、サーマルヘッドＳから発生した熱は、保護層１０３を通過して可逆性感熱記録層１０２に達し、その到達温度に応じて透明な消去状態と白濁した記録状態のいずれかになりこの変化は可逆的である。例えば、可逆性感熱記録層１０２が記録状態であれば、下地となるアルミニウム蒸着層１０１の鏡色を背景にして白色の記録情報を観察することができる。尚、可逆性感熱記録層１０２の厚さについては、記録時の白濁度を高めるため、通常、６．０μｍ以上にする必要があった。

【０００６】ところで、このようなサーマルヘッドによる記録・消去方式においては、熱は上記保護層１０３の上面側から伝わってくるので、この保護層１０３を厚くすると可逆性感熱記録層１０２の記録・消去が困難になる場合があった。このため、上記保護層１０３の厚さは２．０μｍ程度と薄く設定せざるを得なかった。しかし、保護層１０３の厚さが薄いと、サーマルヘッド以外の外部からの熱に対しても可逆性感熱記録層１０２は反応してしまうので、外部から熱が加わることにより書き込みデータが消失してしまったり、故意に加熱して記録情報を改ざん・偽造することも容易にできてしまう。従って、サーマルヘッド用の可逆性感熱記録媒体は記録情報の熱的安定性に劣り、記録情報の改ざん・偽造がされ易いため、フリペードカードのような金券ではその適用範囲が限定されてしまうという問題点があった。

【０００７】一方、熱源として上記サーマルヘッドに代えレーザ光を利用する感熱記録方法も提案されている（特開昭４８－８５１５３号公報、特開昭４９－１３１１４２号公報参照）。図１３はこれら公報に記載された従来例に係るレーザ光感熱記録用の可逆性感熱記録媒体の断面図を示している。すなわち、この感熱記録媒体Ａは、基材１００上にアルミニウム蒸着層１０１、光熱変

換層１０４、可逆性感熱記録層１０２、保護層１０３が順次積層された構成となっている。また、レーザ光は半導体レーザしから発せられ、集光光学系Ｆによって集光され、保護層１０３、可逆性感熱記録層１０２を透過して光熱変換層１０４で吸収され熱に変換される。そして、上記光熱変換層１０４で発生した熱は可逆性感熱記録層１０２に伝わり、サーマルヘッドを用いた場合と同様に上記可逆性感熱記録層１０２はその到達温度により透明な消去状態と白濁した記録状態のいずれかになる。このようにレーザ光を利用する感熱記録媒体においては、その熱源が感熱記録媒体の内部に存在することになるため上記保護層１０３の厚さについて任意な値を採ることが可能になる。従って、サーマルヘッドを用いた場合に較べて保護層１０３の厚みを大きく設定できるため、外部からの熱の影響を受け難くなり記録情報の熱的安定性が向上すると共に改ざん・偽造防止特性の改善も図れる。

【０００８】しかし、レーザ光源においては上記サーマルヘッドの発熱体のように多数個をアレイ化することが困難なため、可逆性の感熱記録媒体に与えられる単位時間当りの熱量が少なくなり、その分、記録・消去速度の著しい低下をもたらすという問題点があった。

【０００９】また、レーザ光の強度はガウシアン分布を有し、サーマルヘッドに較べるとエネルギー密度が非常に高いので、６．０μm以上の厚さを有する可逆性感熱記録層１０３を十分に白濁記録させようとすると光熱変換層１０４付近の温度が２００℃を越えてしまい、可逆性感熱記録層１０２が高温にさらされてその一部が損傷され易いという問題点があった。一方、可逆性感熱記録層１０２を損傷させないようにするには多少の白濁度低下を犠牲にしてもレーザ出力を低減させるしかないので、記録情報の画質やコントラストが低下する問題点もあった。

【００１０】更に、コンピュータ、ワードプロセッサ等の出力やプリペードカード上に記録する情報は、セキュリティ性を重要視して消去不可能でなければならないものもあるため、消去可能な可逆性の感熱記録しか行うことができないことは、その適用範囲に制約ができるという根本的な問題もあった。

【００１１】

【発明が解決しようとする課題】以上のように従来例に係る感熱記録媒体では、どのような構成を採った場合でも情報の変更・修正特性、改ざん・偽造防止特性、記録の高速性、記録情報の画質・コントラストの内少なくとも１つ以上の問題点を有していた。

【００１２】本発明はこのような問題点に着目してなされたもので、その課題とするところは、高速・高画質の記録が可能で、情報の変更・修正が容易であると共に、改ざん・偽造防止特性が良好な感熱記録媒体を提供することにある。

【００１３】

【課題を解決するための手段】すなわち、請求項１に係る発明は、基材上に、第一の感熱記録層と、樹脂と該樹脂中に分散された光吸収剤を主成分とし光を吸収して熱を発生する光熱変換層と、樹脂と該樹脂中に分散された有機低分子物質を主成分とし温度に依存してその透明度が可逆的に変化する第二の感熱記録層とが順次形成されていることを特徴とするものである。

【００１４】そして、この請求項１記載の発明に係る感熱記録媒体においては上記光熱変換層を介して第一の感熱記録層と第二の感熱記録層を備えているため、表面側に位置する第二の感熱記録層に対しサーマルヘッドを用いた加熱手段により情報の高速記録若しくは消去を行うことが可能となる。この場合、上記光熱変換層はその樹脂成分の作用により断熱層として機能しサーマルヘッドからの熱が基材側に位置する第一の感熱記録層へ伝わり難いため、サーマルヘッドを用いた加熱手段による第二の感熱記録層へ情報の記録若しくは消去がなされた際、第一の感熱記録層への情報の記録若しくは消去がなされることはない。

【００１５】他方、レーザ光を用いた加熱手段により情報の書き込み操作が行われた場合、上記光熱変換層から発生した熱は第一の感熱記録層と第二の感熱記録層へほぼ均等に伝わるため、両感熱記録層の感熱記録温度が大幅に相違しない限り２層同時に情報の記録若しくは消去を行うことが可能となる。そして、第一の感熱記録層に記録された情報については、上記光熱変換層の作用によりサーマルヘッドによる情報の書き替え若しくは消去が困難なため、感熱記録媒体における改ざん・偽造防止特性（セキュリティ性）の改善を図ることが可能となる。

【００１６】尚、上記第一の感熱記録層については、これを不可逆性の感熱記録材料で構成してもよいし可逆性の感熱記録材料で構成してもよく任意である。但し、不可逆性の感熱記録材料で構成した場合、第一の感熱記録層に消去不可能な情報を書き込むことができるためセキュリティ性のより改善が図れる。請求項２に係る発明はこのような技術的理由によりなされている。

【００１７】すなわち、請求項２に係る発明は、請求項１記載の発明に係る感熱記録媒体を前提とし、第一の感熱記録層が、不可逆性の感熱記録材料で構成されていることを特徴とするものである。

【００１８】尚、不可逆性の感熱記録材料としては、例えば、クリスタルバイオレットラクトン等無色のロイコ染料とビスフェノールＡ等の酸性物質を記録層内に含有させたもの等が挙げられる。すなわち、この材料においては、サーマルヘッド等の加熱手段により記録層を加熱すると無色のロイコ染料若しくは酸性物質の一方又は両方が溶融して化学的に反応し、ロイコ染料のラクトン環が切れて加熱部位が青紫に発色するものである。

【００１９】他方、第一の感熱記録層について第二の感

熱記録層と同様に可逆性の感熱記録材料で構成した場合、両感熱記録層に対しレーザ光を用いた加熱手段により同一の記録情報を記録できるため、各記録層の厚さを従来の半分に設定しても白濁度において問題を生ずることがなく、かつ、厚さが半分になることから照射するレーザ光の出力を低減させることも可能となる。請求項３に係る発明はこのような技術的理由からなされている。

【００２０】すなわち、請求項３に係る発明は、請求項１記載の感熱記録媒体を前提とし、第一の感熱記録層が、樹脂と該樹脂中に分散された有機低分子物質を主成分とし温度に依存してその透明度が可逆的に変化する可逆性の感熱記録材料で構成されていることを特徴とするものである。

【００２１】次に、請求項１～３記載の発明に係る感熱記録媒体においては第一の感熱記録層と第二の感熱記録層の感熱記録濃度が大幅に相違しない限りレーザ光を用いた加熱手段により２層同時に情報の記録若しくは消去がなされるが、光熱変換層と第二の感熱記録層との間に、例えばポリエステル樹脂のような熱伝導率の低い樹脂で構成された断熱層を介在させた場合、光熱変換層で生じた熱は断熱層により第二の感熱記録層へ伝わり難くなるため第一の感熱記録層のみに情報を記録若しくは消去することが可能となる。請求項４に係る発明はこのような技術的理由によりなされている。

【００２２】すなわち、請求項４に係る発明は、請求項１、２又は３記載の感熱記録媒体を前提とし、光熱変換層と第二の感熱記録層との間に断熱層が介在していることを特徴とするものである。

【００２３】次に、請求項１～４記載の発明に係る感熱記録媒体においては第一の感熱記録層と第二の感熱記録層が光熱変換層を間に介して設けられた構成になっているが、基材側から順に光熱変換層と不可逆性の第一の感熱記録層及び可逆性の第二の感熱記録層を設けた構成にしても請求項１～４記載の発明に係る感熱記録媒体と同様の機能を有する感熱記録媒体を得ることができる。但し、レーザ光が照射された際、表面側に位置する第二の感熱記録層に較べて光熱変換層に隣接する第一の感熱記録層はより高温に加熱されるため、両感熱記録層の感熱記録温度が略等しい場合、両感熱記録層の同時記録が困難となる。他方、サーマルヘッドを用いた加熱手段により第二の感熱記録層に情報の記録を行う際、第一の感熱記録層と第二の感熱記録層との間に光熱変換層が介在しないため第一の感熱記録層にも情報の記録がなされる場合が生ずる。請求項５に係る発明はこのような技術的理由によりなされている。

【００２４】すなわち、請求項５に係る発明は、基材上に、樹脂と該樹脂中に分散された光吸収剤を主成分とし光を吸収して熱を発生する光熱変換層と、不可逆性の第一の感熱記録層と、樹脂と該樹脂中に分散された有機低分子物質を主成分とし温度に依存してその透明度が可逆的に変化する第二の感熱記録層とが順次形成されており、かつ、上記第一の感熱記録層の感熱記録濃度が第二の感熱記録層の感熱記録濃度より高温であることを特徴とするものである。

【００２５】そして、請求項５記載の発明に係る感熱記録媒体においては第一の感熱記録層の感熱記録濃度が第二の感熱記録層の感熱記録濃度より高いため、レーザ光が照射され第一の感熱記録層の加熱温度が第二の感熱記録層の加熱温度より高くなっても両感熱記録層の同時記録が可能であり、かつ、サーマルヘッドを用いた加熱手段により第二の感熱記録層に情報の記録若しくは消去を行ってもその感熱記録濃度が第二の感熱記録層より高い第一の感熱記録層においてはその熱的影響を受けることがない。

【００２６】尚、請求項５記載の発明に係る感熱記録媒体において第一の感熱記録層内に光吸収剤が添加された場合、この第一の感熱記録層は光熱変換層を兼ねることになる。請求項６に係る発明はこのような技術的理由からなされている。

【００２７】すなわち、請求項６に係る発明は、基材上に、光吸収剤が添加された不可逆性の第一の感熱記録層と、樹脂と該樹脂中に分散された有機低分子物質を主成分とし温度に依存してその透明度が可逆的に変化する第二の感熱記録層とが順次形成されており、かつ、上記第一の感熱記録層の感熱記録濃度が第二の感熱記録層の感熱記録温度より高温であることを特徴とするものである。

【００２８】また、請求項４に係る発明と同様に、第一の感熱記録層と第二の感熱記録層との間にポリエステル樹脂のような熱伝導率の低い樹脂で構成された断熱層を介在させた場合にも、レーザ光を用いた加熱手段による第一の感熱記録層のみの情報の記録を行うことが可能となる。請求項７に係る発明はこのような技術的理由からなされている。

【００２９】すなわち、請求項７に係る発明は、請求項５又は６記載の発明に係る感熱記録媒体を前提とし、第一の感熱記録層と第二の感熱記録層との間に断熱層が介在していることを特徴とするものである。

【００３０】このような技術的手段において可逆性の感熱記録層の一部を構成する樹脂材料としては、以下に述べる有機低分子物質とその屈折率が近似しかつ相溶性がないと共に、機械的強度に優れしかもフィルム形成能を有する透明性良好な熱可塑性樹脂が挙げられ、その具体例としては飽和共重合ポリエステル等のポリエステル樹脂；ポリ塩化ビニル樹脂；塩化ビニル－酢酸ビニル共重合体、塩化ビニル－酢酸ビニル－ビニルアルコール共重合体、塩化ビニル－酢酸ビニル－マレイン酸共重合体、塩化ビニル－アクリレート共重合体等の塩化ビニル共重合体；ポリ塩化ビニリデン樹脂；塩化ビニリデン－塩化ビニル共重合体、塩化ビニリデン－アクリロニトリル共

重合体等の塩化ビニリデン共重合体；ポリアミド樹脂；シリコン樹脂；ポリアクリレート若しくはポリメタクリレート樹脂又はこれらの共重合体等がありこれら単独或いは２種以上混合して適用することができる。また、この樹脂材料中に分散される有機低分子物質としては、酸素、硫黄、窒素、ハロゲンのうち少なくとも一つの原子を含み、炭素数が１０～４０でその分子量が１００～７００であり、かつ、融点が５０～１５０℃の範囲にある有機化合物が挙げられ、その具体例としてはアルカノール、カルカンジオール、ハロゲンアルカノール、ハロゲンアルカンジオール等の高級アルコール；高級脂肪族アミン；アルカン、アルケン、アルキン及びこれらのハロゲン置換体；シクロアルカン、シクロアルケン、シクロアルキン等の環状化合物；飽和カルボン酸、不飽和モノカルボン酸、ジカルボン酸又はこれらのエステル、アミド、アンモニウム塩；飽和若しくは不飽和ハロゲン脂肪酸又はこれらのエステル、アミド、アンモニウム塩；アクリルカルボン酸又はこれらのエステル、アミド、アンモニウム塩；ハロゲンアリルカルボン酸又はこれらのエステル、アミド、アンモニウム塩；チオアルコール又はこれらのカルボン酸エステル；チオカルボン酸又はこれらのエステル、アミド、アンモニウム塩等があり、これら単独或いは２種以上混合して適用することができる。

【００３１】また、感熱記録層等を支持する基材としては、例えば、紙、ポリエチレンテレフタレート、ポリエチレンナフタレート、ポリカーボネート等のシート、塩化ビニル等のカード等が挙げられ、この基材上にアルミニウム、錫、銀、マグネシウム、クロム、ニッケル等の光反射性金属層を蒸着法等の適宜製膜手段により形成したり、カーボン等の適宜着色剤が配合された着色層を形成して適用される。

【００３２】

【作用】請求項１記載の発明に係る感熱記録媒体によれば、光熱変換層を介して第一の感熱記録層と第二の感熱記録層を備え、かつ、上記光熱変換層はその樹脂成分の作用により断熱層として機能するため、表面側に位置する第二の感熱記録層に対してのみサーマルヘッドを用いた加熱手段により情報の高速記録若しくは消去を行うことが可能となる。

【００３３】また、レーザ光を用いた加熱手段により情報の書き込み操作が行われた場合、上記光熱変換層から発生した熱は第一の感熱記録層と第二の感熱記録層へほぼ均等に伝わるため、両感熱記録層の感熱記録温度が大幅に相違しない限り２層同時に情報の記録若しくは消去を行うことが可能となる。

【００３４】更に、第一の感熱記録層に記録された情報については、上記光熱変換層の作用によりサーマルヘッドによる情報の書き替え若しくは消去が困難なため、感熱記録媒体における改ざん・偽造防止特性の改善を図ることも可能となる。

【００３５】次に、請求項２記載の発明に係る感熱記録媒体によれば、上記第一の感熱記録層が不可逆性の感熱記録材料で構成されており、この第一の感熱記録層に消去不可能な情報を書き込むことができるため、上記改ざん・偽造防止特性の改善を更に図ることが可能となる。

【００３６】また、請求項３記載の発明に係る感熱記録媒体によれば、上記第一の感熱記録層が樹脂と該樹脂中に分散された有機低分子物質を主成分とし温度に依存してその透明度が可逆的に変化する可逆性の感熱記録材料で構成され、第一の感熱記録層と第二の感熱記録層とが共に可逆性の感熱記録材料で構成されていることから両感熱記録層に対しレーザ光を用いた加熱手段により同一の記録情報を記録できるため、各記録層の厚さを従来の半分に設定しても白濁度において問題を生ずることがなく、かつ、厚さが半分になることから、その分照射するレーザ光の出力を低減させることも可能となる。

【００３７】また、請求項４記載の発明に係る感熱記録媒体によれば、光熱変換層と第二の感熱記録層との間に断熱層が介在しており、上記光熱変換層で生じた熱は断熱層により第二の感熱記録層へ伝わり難くなるため、レーザ光を用いた加熱手段により第一の感熱記録層に対してのみ情報の記録若しくは消去を行うことが可能となる。

【００３８】次に、請求項５記載の発明に係る感熱記録媒体によれば、基材上に、樹脂と該樹脂中に分散された光吸収剤を主成分とし光を吸収して熱を発生する光熱変換層と、不可逆性の第一の感熱記録層と、樹脂と該樹脂中に分散された有機低分子物質を主成分とし温度に依存してその透明度が可逆的に変化する第二の感熱記録層とが順次形成されており、かつ、上記第一の感熱記録層の感熱記録温度が第二の感熱記録層の感熱記録温度より高温であるため、レーザ光が照射され第一の感熱記録層の加熱温度が第二の感熱記録層の加熱温度より高くなっても両感熱記録層の同時記録が可能であり、かつ、サーマルヘッドを用いた加熱手段により第二の感熱記録層に情報の記録若しくは消去を行ってもその感熱記録温度が第二の感熱記録層より高い第一の感熱記録層においてはその熱的影響を受けることがない。

【００３９】また、請求項６記載の発明に係る感熱記録媒体によれば、基材上に、光吸収剤が添加された不可逆性の第一の感熱記録層と、樹脂と該樹脂中に分散された有機低分子物質を主成分とし温度に依存してその透明度が可逆的に変化する第二の感熱記録層とが順次形成されており、第一の感熱記録層内に光吸収剤が添加されているため光熱変換層の形成を省略することが可能となる。

【００４０】また、上記第一の感熱記録層の感熱記録温度が第二の感熱記録層の感熱記録温度より高温であるため、請求項５に係る感熱記録媒体と同様に、レーザ光が照射され第一の感熱記録層の加熱温度が第二の感熱記録

層の加熱温度より高くなっても両感熱記録層の同時記録が可能であり、かつ、サーマルヘッドを用いた加熱手段により第二の感熱記録層に情報の記録若しくは消去を行ってもその感熱記録温度が第二の感熱記録層より高い第一の感熱記録層においてはその熱的影響を受けることがない。

【0041】また、請求項7記載の発明に係る感熱記録媒体によれば、第一の感熱記録層と第二の感熱記録層との間に断熱層が介在しており、上記第一の感熱記録層で生じた熱は断熱層により第二の感熱記録層へ伝わり難くなるため、請求項4に係る感熱記録媒体と同様に、レーザ光を用いた加熱手段により第一の感熱記録層に対してのみ情報の記録を行うことが可能となる。

【0042】

【実施例】以下、本発明の実施例について図面を参照して詳細に説明する。

【0043】〔実施例1〕この実施例に係る感熱記録媒体は、図1に示すように紙、ポリエチレンテレフタレートのシート、塩化ビニルのカード等から成る基材1と、この基材1上に設けられたアルミニウム層2と、このアルミニウム層2上に設けられた第一の感熱記録層3と、この第一の感熱記録層3上に設けられた光熱変換層4と、この光熱変換層4上に設けられ記録時の温度に依存して光学濃度が変化し記録と消去が可逆的に行える第二の感熱記録層5と、この第二の感熱記録層5上に設けられた保護層6とでその主要部が構成されている。

【0044】以下、この感熱記録媒体Aの製造方法について説明する。

【0045】まず、上記基材1上に50～100nmの膜厚のアルミニウム層2を蒸着により形成する。

【0046】次に、第一の感熱記録層3は、加熱することにより発色する物質であれば可逆的に記録・消去ができる可逆性感熱記録層でも、不可逆的で記録のみ可能な不可逆性感熱記録層でもよい。例えば、上記可逆性感熱記録層としては、特開昭55－154198号公報に記載されたポリ塩化ビニル等の熱可塑性樹脂とこの樹脂に分散された高級脂肪酸等の有機低分子物質を主成分とし記録時の到達温度により生じる透明状態と白濁状態の差から可視画像を形成するもの等が適用でき、この可逆性記録材料の分散液をアルミニウム層2上にワイヤーバー等の塗布手段で6．0～10．0μmの厚さに塗布して形成できる。一方、上記不可逆性感熱記録層としては、例えば、フェノール系顕色剤とバインダーとしてスチレンアクリル系水中に分散させて成る顕色剤分散液と、発色剤としてロイコ染料を水中に分散させて成る発色剤分散液とを7：3の割合（体積比）で混合し、これをワイヤーバー等の塗布手段でアルミニウム層2上に3．0μmの厚さに塗布して形成できる。

【0047】また、上記第二の感熱記録層5は可逆性の感熱記録材料で構成されており、例えば、特開昭55－154198号公報に記載されたポリ塩化ビニル等の熱可塑性樹脂とこの樹脂に分散された高級脂肪酸等の有機低分子物質を主成分とし記録時の到達温度により生じる透明状態と白濁状態の差から可視画像を形成するもの等が適用でき、この可逆性記録材料の分散液をアルミニウム層2上にワイヤーバー等の塗布手段で6．0～10．0μmの厚さに塗布して形成できる。

【0048】更に、上記保護層6は、従来例に係る感熱記録媒体と同様に、耐熱性や耐摩耗性の良好な樹脂（例えば弗素系樹脂やシリコーン系樹脂等）を溶剤中に分散させたものを第二の感熱記録層5上にワイヤーバー等の塗布手段で塗布して形成できる。尚、保護層6の厚さは、第二の感熱記録層5をサーマルヘッドにより記録・消去できるようにするため、約3．0～5．0μmと薄く設定されている。

【0049】このようにして製造された感熱記録媒体Aの情報記録・消去特性について以下説明する。

【0050】図2は、感熱記録媒体Aに情報を記録・消去するための情報記録・消去装置のブロック構成図である。感熱記録媒体Aは、Y方向に搬送可能な搬送機構7上に載置されている。その上面に接するようにサーマルヘッド8が設けられている。サーマルヘッド8は、駆動用電源9、コントロール・ユニット10に順次接続されている。一方、感熱記録媒体A上面に略向かい合ってX方向に走査可能なガルバノミラー11が配置されており、このガルバノミラー11と同一光軸上に集光光学系12、レーザダイオード13が順次設置されている。レーザダイオード13は、ドライバ14、コントロール・ユニット10に順次接続されている。

【0051】感熱記録媒体Aは、搬送機構7によりY方向に搬送される。サーマルヘッド8にはコントロール・ユニット10の発する制御信号に応じた電力が駆動用電源9から加えられる。サーマルヘッド8から発生した熱は感熱記録媒体Aの保護層6を通して第二の感熱記録層5に達する。保護層6の厚さは約3．0μmと薄いため第二の感熱記録層5は記録・消去に十分な温度にまで熱せられる。第二の感熱記録層5は可逆性感熱記録材料により構成されており、その記録特性は図3のグラフ図に示すような到達温度と光学濃度との関係を有している。ここで到達温度とは、記録・消去動作時に第二の感熱記録層5が到達したピーク温度で、その温度T1とT2の中間にあれば第二の感熱記録層5は室温に下がった後も光学濃度の高い透明状態となる。逆に、到達温度がT2以上の場合には、第二の感熱記録層5は光学濃度の低い白濁状態となる。温度T1とT2は、60～120℃の範囲で自由に設定可能であり、記録・消去状態が最適になるように決めることができる。サーマルヘッドから発生した熱は、光熱変換層4が熱伝導率の低い樹脂類を主成分としているため、その断熱作用により第一の感熱記録層3にはあまり伝わらず第一の感熱記録層3には記録

は行われない。従って、サーマルヘッドにより第二の感熱記録層５のみに対して記録・消去を行うことができる。

【００５２】一方、上記レーザダイオード１３は、コントロール・ユニット１０からの制御信号に応じてドライバ１４から供給される電力により発光する。レーザ光は、集光光学系１２、ガルバノミラー１１を通って感熱記録媒体Ａに達する。更に、レーザ光は、感熱記録媒体Ａの保護層６、第二の感熱記録層５を透過して光熱変換層４内で集光し、光から熱に変換される。光熱変換層４から発生した熱は、第一の感熱記録層３と第二の感熱記録層５にほぼ均一に伝わる。図４は、このとき第一の感熱記録層３、光熱変換層４、第二の感熱記録層５の断面内に生じる温度分布を示した断面図で、等温線Ｔを見れば明らかなようにほぼ同一の温度分布が第一の感熱記録層３と第二の感熱記録層５に形成される。従って、両感熱記録層３、５が同じ温度で発色する場合（すなわち両感熱記録層の感熱記録温度が略同一の場合）には２層同時に記録を行うことができる。

【００５３】このように、サーマルヘッド８によって第二の感熱記録層５のみを記録・消去でき、レーザ光によって第一の感熱記録層３と第二の感熱記録層５の両方に同時に記録することができる。従って、記録する情報の特性に応じてすぐに消去してしまうような情報は第二の感熱記録層５にのみサーマルヘッド８で記録する一方、セキュリティに関わるような重要な情報についてはレーザ光によって第一の感熱記録層３と第二の感熱記録層５に同時記録するようにすればよい。このような情報の特性に応じた記録層の使い分けをすることにより効率的な情報の記録・消去が可能である。

【００５４】例えば、第二の感熱記録層５にのみ記録した情報は、サーマルヘッド８で簡単に消去できるので、レーザ光のみでしか記録・消去ができなかった従来例に係るレーザ光感熱記録用の可逆性感熱記録媒体と比較して、高速な情報の記録・消去が可能である。また、第一の感熱記録層３と第二の感熱記録層５に同時記録した情報は、サーマルヘッド８や外部からの熱では第二の感熱記録層５しか消去されず第一の感熱記録層３の情報は残される。従って、外部からの熱による情報の消失や改ざん・偽造を防止することが可能である。特に、通常の使用状態では、サーマルヘッド８あるいはレーザ光のどちらによる記録でも常に第二の感熱記録層５には情報が記録されるため、その下側に存在する第一の感熱記録層３については気付かれ難い。更に、第一の感熱記録層３と第二の感熱記録層５にレーザ光で同時記録した後、第二の感熱記録層５の情報をサーマルヘッド８で一旦消去し、残った第一の感熱記録層３の情報の上部にあたる第二の感熱記録層５にサーマルヘッド８によりダミー情報を記録すれば第一の感熱記録層３に記録された情報を隠すことができる。尚、第一の感熱記録層３に記録された情報を読み取るには、サーマルヘッドを用いた加熱手段により第二の感熱記録層５を透明状態に設定することにより可能となる。従って、従来例に係る各種の感熱記録媒体と比較して遥かにセキュリティ性が高い利点を有する。

【００５５】また、この実施例において第一の感熱記録層３を不可逆性の感熱記録材料にて構成したばあい、この第一の感熱記録層３に消去不可能な情報を書き込むことができ、更にセキュリティ性を向上させることが可能となる。

【００５６】次に、この実施例の変形例として、上記第一の感熱記録層３が第一の感熱記録層５と同様に可逆性の感熱記録材料で構成されている感熱記録媒体について説明する。すなわち、この感熱記録媒体においては、第一の感熱記録層３と第二の感熱記録層５の厚さをそれぞれ３．０～５．０μｍと上記実施例に係る感熱記録媒体の１／２にし、両感熱記録層３、５全体で６．０～１０．０μｍの厚さに設定されており、かつ、レーザ光のみでしか記録・消去ができないように上記保護層６の厚さについては５．０μｍ以上に設定されている。

【００５７】この変形例に係る感熱記録媒体のレーザ光による記録・消去特性について、単一の感熱記録層しか備えていない従来例に係る可逆性感熱記録媒体と比較して説明する。図５、図６は、それぞれ両感熱記録層３、５を設けた変形例に係る感熱記録媒体と、単一の感熱記録層１０２しか備えていない従来例に係る可逆性感熱記録媒体に対して同じエネルギーのレーザ光を照射したときに生ずる温度分布を表した概略断面図である。図５及び図６の等温線Ｔを見れば明らかなように、光熱変換層４、１０４を中心にして略同様な温度分布が形成されているが、光熱変換層４、１０４の位置が異なるために記録可能な温度に達している斜線部分の面積が大きく異なることが確認できる。図６に示された従来例に係る感熱記録媒体においては感熱記録層１０２の上表面まで完全に記録可能な温度に達していないのに対し、図５に示された変形例に係る感熱記録媒体においては両感熱記録層３、５の下表面から上表面まで完全に記録可能な温度に達している。

【００５８】そして、従来例に係る上記感熱記録媒体において完全な記録を行おうとするとレーザ光の強度を更に高くすることが必要になり、そのとき光熱変換層１０４付近の感熱記録層１０２下部は２００℃を越える高温になるため感熱記録層の熱破壊が生じやすくなる。このことから、変形例に係る感熱記録媒体においては、従来例に係る感熱記録媒体より画質が良好な情報あるいは画像をより低エネルギーのレーザ光で記録可能であることが理解できる。また、レーザダイオードは出力が大きくなると価格が急上昇するため、記録エネルギーの低減は経済的に大きな効果も生じさせる。

【００５９】［実施例２］この実施例に係る感熱記録媒

体は、図7に示すように基材1と、この基材1上に設けられたアルミニウム層2と、このアルミニウム層2上に設けられた光熱変換層4と、この光熱変換層4上に設けられかつ不可逆性の感熱記録材料から成る第一の感熱記録層15と、この第一の感熱記録層15上に設けられ記録時の温度に依存して光学濃度が変化し記録と消去が可逆的に行える第二の感熱記録層5と、この第二の感熱記録層5上に設けられた保護層6とでその主要部が構成されている。

【0060】ここで、上記第一の感熱記録層15は、例えば、フェノール系顕色剤とバインダーとしてスチレンアクリルを水中に分散させて成る顕色剤分散液と、発色剤としてロイコ染料を水中に分散させて成る発色剤分散液とを7：3の割合で混合し、これをワイヤーバー等の塗布手段で光熱変換層4上に3．0μmの厚さに塗布して形成されおりその発色温度は150℃以上である。これに対し、実施例1と同一の材料で構成されている第二の感熱記録層5の白濁記録温度は100℃以上であり、第一の感熱記録層15の発色温度に較べて低い値を有している。尚、第一の感熱記録層15以外の構成材料は実施例1と同一のため説明を省略する。

【0061】そして、この実施例に係る感熱記録媒体に対しレーザ光を照射すると、このレーザ光は光熱変換層4で熱に変換され第一の感熱記録層15、第二の感熱記録層5に順次伝わっていく。温度分布は光熱変換層4に近い第一の感熱記録層15の方が当然高温になるが、第一の感熱記録層15はロイコ染料等を主成分とした不可逆性の感熱記録材料により構成されているためその発色温度は上述したように150℃以上と高い。これに対し、第二の感熱記録層5は可逆性の感熱記録材料で構成されその白濁記録温度は100℃以上と低いため、両感熱記録層5、15の同時記録が可能である。

【0062】一方、サーマルヘッドによる記録の際、第二の感熱記録層5の下面は100℃以上になれば記録ができるので、そのとき第一の感熱記録層15が発色温度に達して同時に記録されてしまうことはない。

【0063】従って、実施例1に係る感熱記録媒体と同様に、サーマルヘッドによる第二の感熱記録層5のみへの記録・消去と、レーザ光による第一の感熱記録層15と第二の感熱記録層5の同時記録が可能である。

【0064】〔実施例3〕この実施例に係る感熱記録媒体は、図8に示すように基材1と、この基材1上に設けられたアルミニウム層2と、このアルミニウム層2上に設けられかつ光吸収剤が添加された不可逆性の感熱記録材料から成る第一の感熱記録層16と、この第一の感熱記録層16上に設けられ記録時の温度に依存して光学濃度が変化し記録と消去が可逆的に行える第二の感熱記録層5と、この第二の感熱記録層5上に設けられた保護層6とでその主要部が構成されている。尚、第一の感熱記録層16中に添加されている光吸収剤は、使用するレーザ光の波長に合致した吸収特性を有するものを選択すればよい。例えば、赤外の半導体レーザでは、フタロシアニンのような近赤外吸収剤を使用する。

【0065】そして、この実施例に係る感熱記録媒体においては、光吸収剤が添加された第一の感熱記録層16に不可逆性の感熱記録機能並びにレーザ光の吸収と熱への変換機能を兼備させていたため、光熱変換層を備えていないにも拘らず実施例2に係る感熱記録媒体と同様に、サーマルヘッドによる第二の感熱記録層5のみへの記録・消去と、レーザ光による第一の感熱記録層16と第二の感熱記録層5の同時記録が可能となる。また、この感熱記録媒体においては、実施例1及び2に係る感熱記録媒体と較べて光熱変換層4を要しないため、その分、製造時における塗布層数が少なくなり生産工程の低減が図れる利点を有している。

【0066】上述した実施例1～3においてレーザ光による記録は、必ず第一の感熱記録層と第二の感熱記録層とが同時に行われる構成になっているが、用途によっては同時記録が行われない方が望ましい場合がある。このような場合、第一の感熱記録層と第二の感熱記録層とを熱的に隔離する断熱層を設けることにより対処することが可能である。

【0067】すなわち、実施例1に係る感熱記録媒体においてはその光熱変換層4と第二の感熱記録層5との間に断熱層17を介在させる構成とし（図9参照）、実施例2に係る感熱記録媒体においては第一の感熱記録層15と第二の感熱記録層5との間に断熱層17を介在させる構成とし（図10参照）、また、実施例3に係る感熱記録媒体においては第一の感熱記録層16と第二の感熱記録層5との間に断熱層17を介在させる構成（図10参照）にすることにより対処することが可能である。尚、上記断熱層17としては、例えば、ポリエステル樹脂のような熱伝導率の低い樹脂を適用することができる。

【0068】そして、このような構成にすると、感熱記録媒体に対してレーザ光を照射したとき、光熱変換層4あるいは第一の感熱記録層16から発生する熱は第一の感熱記録層3、15、16には伝わるが、第二の感熱記録層5へは上記断熱層17が作用してあまり伝わらなくなる。従って、レーザ光の照射時には第一の感熱記録層3、15、16にのみ記録が行われることになる。すなわち、第一の感熱記録層3、15、16はレーザ光による感熱記録専用となり、第二の感熱記録層5はサーマルヘッドによる感熱記録専用とすることができる。

【0069】

【発明の効果】請求項1に係る発明によれば、表面側に位置する第二の感熱記録層に対してのみサーマルヘッドを用いた加熱手段により情報の高速記録若しくは消去が行え、かつ、レーザ光を用いた加熱手段により第一の感熱記録層と第二の感熱記録層に対し同時に情報の記録若

しくは消去が行えると共に、第一の感熱記録層に記録された情報については光熱変換層の一部を構成する樹脂材料の断熱作用によりサーマルヘッドによる情報の書き替え若しくは消去が困難となる。

【００７０】従って、サーマルヘッドによる記録・消去の高速性を保ちながら必要に応じてレーザ光による両感熱記録層への同時記録のような極めてセキュリティ性の高い記録を実現できるため、記録・消去が高速かつ容易でありしかも改ざん・偽造防止性に優れた情報の記録・消去を行える効果を有する。

【００７１】次に、請求項２に係る発明によれば、第一の感熱記録層が不可逆性の感熱記録材料で構成されこの第一の感熱記録層に消去不可能な情報を書き込むことができるため、改ざん・偽造防止特性の改善を更に図れる効果を有する。

【００７２】また、請求項３に係る発明によれば、第一の感熱記録層と第二の感熱記録層とが共に可逆性の感熱記録材料で構成されていることから両感熱記録層に対しレーザ光を用いた加熱手段により同一の記録情報を記録できるため、各記録層の厚さを従来の半分に設定しても白濁度において問題を生ずることがなく、かつ、厚さが半分になることから、その分照射するレーザ光の出力を低減できる効果を有する。

【００７３】また、請求項４に係る発明によれば、光熱変換層と第二の感熱記録層との間に断熱層が介在し上記光熱変換層で生じた熱がこの断熱層により第二の感熱記録層へ伝わり難くなるため、レーザ光を用いた加熱手段により第一の感熱記録層に対してのみ情報の記録若しくは消去を行える効果を有する。

【００７４】次に、請求項５に係る発明によれば、第一の感熱記録層の感熱記録温度が第二の感熱記録層の感熱記録温度より高温であるため、レーザ光が照射され第一の感熱記録層の加熱温度が第二の感熱記録層の加熱温度より高くなっても両感熱記録層の同時記録が可能であり、かつ、サーマルヘッドを用いた加熱手段により第二の感熱記録層に情報の記録若しくは消去を行ってもその感熱記録温度が第二の感熱記録層より高い第一の感熱記録層においてはその熱的影響を受けることがない。

【００７５】従って、請求項１～４に係る感熱記録媒体と同様に、記録・消去が高速かつ容易でありしかも改ざん・偽造防止性に優れた情報の記録・消去を行える効果を有する。

【００７６】また、請求項６に係る発明によれば、第一の感熱記録層内に光吸収剤が添加されているため光熱変換層の形成を省略できると共に、記録・消去が高速かつ容易でありしかも改ざん・偽造防止性に優れた情報の記録・消去を行える効果を有する。

【００７７】また、請求項７に係る発明によれば、第一の感熱記録層と第二の感熱記録層との間に断熱層が介在し上記第一の感熱記録層で生じた熱は断熱層により第二の感熱記録層へ伝わり難くなるため、請求項４に係る感熱記録媒体と同様に、レーザ光を用いた加熱手段により第一の感熱記録層に対してのみ情報の記録を行える効果を有する。

【図面の簡単な説明】

【図１】実施例１に係る感熱記録媒体の構成を示す断面図。

【図２】実施例で使用された記録・消去装置のブロック構成図。

【図３】可逆性感熱記録材料の到達温度と光学濃度との関係を示すグラフ図。

【図４】実施例１に係る感熱記録媒体の記録時における温度分布を示す断面図。

【図５】変形例に係る感熱記録媒体の記録時における温度分布を示す断面図。

【図６】従来例に係る感熱記録媒体の記録時における温度分布を示す断面図。

【図７】実施例２に係る感熱記録媒体の構成を示す断面図。

【図８】実施例３に係る感熱記録媒体の構成を示す断面図。

【図９】実施例１の変形例に係る感熱記録媒体の構成を示す断面図。

【図１０】実施例２の変形例に係る感熱記録媒体の構成を示す断面図。

【図１１】実施例３の変形例に係る感熱記録媒体の構成を示す断面図。

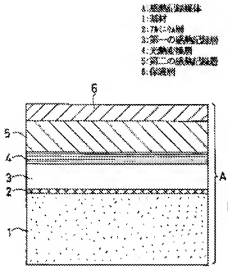
【図１２】従来例に係る感熱記録媒体の構成を示す断面図。

【図１３】他の従来例に係る感熱記録媒体の構成を示す断面図。

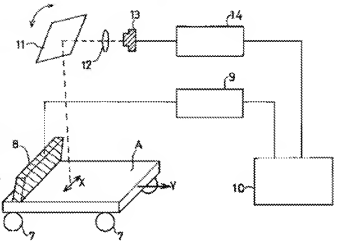
【符号の説明】

A　感熱記録媒体
1　基材
2　アルミニウム層
3　第一の感熱記録層
4　光熱変換層
5　第二の感熱記録層
6　保護層

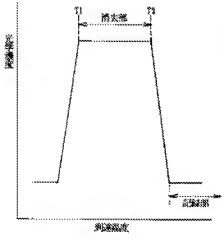
【図１】



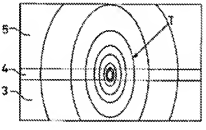
【図２】



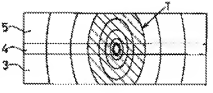
【図３】



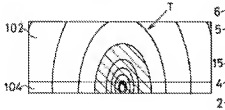
【図４】



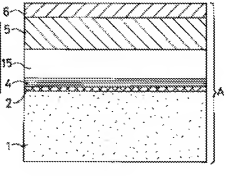
【図５】



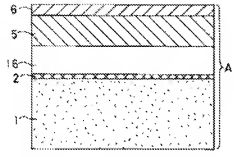
【図６】



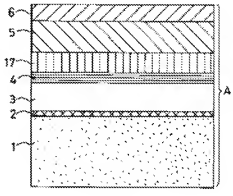
【図７】



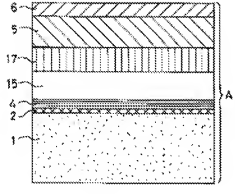
【図8】



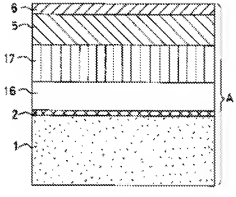
【図9】



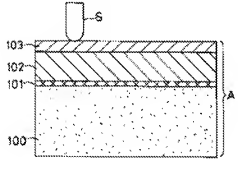
【図10】



【図11】



【図12】



【図13】